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ABSTRACT

In the spring of 1969, a short computer course comprising three hours of lectures and two hours of working with a computer was offered at Hofstra University to 101 natural science students. A questionnaire, which was designed to assess the impact of the 5-hour course, was administered to the students before and after they took the course. This paper presents evidence on the extent to which the students' attitudes toward and appraisal of the computer changed after they had taken the course. Post-course student responses to five questions in the questionnaire revealed that 34 to 52% of the students felt they had learned a great deal; 50% indicated that too little time, and the other half felt that too much time, was spent on various parts of the course; the average student spent 2.7 hours listening to lectures and 2.4 hours studying or working at the computer center; the computer course, when compared to the regular course, approximately matched the regular course in terms of amount learned and ease of understanding, but was considered to be a little more interesting; and 63 of the students made suggestions for improving the course. These and other data seem to confirm the value of the short computer course, especially since it resulted in more favorable student views of the computer and of its general usefulness. The paper discusses some of the course's limitations and suggests improvements for future presentations. The questionnaire and six tables are appended. (WM)

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CENTER FOR THE STUDY OF HIGHER EDUCATION

HOFSTRA UNIVERSITY

The Effect of a Short Computer Course on Attitudes Toward the Computer

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Summary

A questionnaire was designed to assess the impact of a five-hour instant-computer-course given to students at Hofstra University in the Spring 1969 semester. Pretest and posttest questionnaires were filled out by 101 students who listened to three hours of lecture about computers and then spent two hours working with the computer.

The data obtained from these students indicate that the short course had a definite effect. In general it tended to result in more favorable views of the computer; in 18 out of 20 comparisons there was a change toward a more favorable view of computers, and 14 of these 18 differences were statistically significant. The computer was perceived as safer, more accurate, more beneficial, more understandable, more productive, etc.

The course also succeeded in changing the students' view of the usefulness of computers. At the conclusion of the course the computer was perceived as more useful in each of the six areas about which the question was asked. This increased usefulness was limited to general usefulness and did not apply to the personal usefulness of the computer to the individual student who took the course. There were no significant differences between the percentage of students who perceived the computer as more personally useful at the end of the course and the percentage who perceived it as less useful.

More was learned from talking to faculty and/or computer personnel than from other aspects of the course. While close to half learned substantially from each part of the course, the other half learned little. One reason for this could have been that the students believed that too little time was devoted to several parts of the course. They would have preferred more time spent on programming instruction, learning to operate the computer, and running the computer. Apparently five hours is too short a time for a course such as this.

Finally, the students made a number of suggestions for improving the course. Over one-third of the students suggested that more time should be spent in the center and/or that the students should get more experience programming. About one-fifth suggested that the course should be longer, and a similar percentage indicated that the lectures should be devoted, at least in part, to the basic operations of the computer.

(Copies of the full report are available from the Center for the Study of Higher Education)

Introduction and Method

During the 1965-1966 academic year at Hofstra University's New College, Dr. Robert Hart, a Teaching Fellow in Physics, developed a short computer instruction "package." The course, of five classroom hours length, was designed with a view to its inclusion as a unit within a regular subject matter course. At first only a dozen New College science majors were involved. But in 1966-1967, the package was offered to all of New College's 85 freshmen, as part of the required physical science course. Later, in 1967-1968, an additional 130 liberal arts students enrolled in main Hofstra's natural science course participated. The offering was repeated in 1968-1969, and plans are being contemplated wherein the package may be included in other courses in the future.

The interest in Hart's presentation led to an attempt to systematically assess its value. Hart has indicated (1969) that the package has been effective. In short quizzes given in his 1967-1968 physical science course, the students apparently were able to write simple programs, predict outputs and correct errors with an average grade of 85%.

The present paper sets forth the evidence on the extent to which the students' attitudes toward the computer and their appraisal of the computer changed following participation in the computer course.

Hart's description of his course, in the 1969 paper cited above, suggests the direction changes in attitude might take. The course consisted of three hours of lecture and two hours at the computer. The first hour of lecture was spent in orienting the students, the remaining two were devoted to technical matters such as "instant" fortran.

> The first hour of lecture tries to convince the students that computers are a Good Thing, or at least relevant to their lives (p. 5).
>
> I.../make/ a few comments about what computers have done in several intriguing fields, and then /ask/ the class to name fields in which the computer could not possibly be relevant--and then I tell them how it is relevant in these fields (p. 5).

The questionnaire used in the present study directly assessed the tactic described in the second quotation. Students were asked to indicate the extent to which they thought computers were useful in various disciplines and in a related fashion they indicated the extent to which they considered the computers personally useful.

A test of the first point made in the orientation lecture--that computers are a good thing, was essentially incorporated in the semantic differential. The semantic differential is a technique of measurement which yields a picture or a profile of a concept, object or idea which is being rated. In the present study, the semantic differential consisted of twenty dimensions used to rate the concept COMPUTER on a five-point scale. The ratings were analyzed, dimension by dimension, so that it would be possible to say, at the end of the analysis, whether students viewed the computer as faster or slower than they did before they took the computer course, as safer or more dangerius, more efficient or less efficient, and so on.

Perhaps the range of the twenty dimensions reflects in large measure a test of Hart's general comment that:

> ...the main object of the package is to give the students a feeling for the usefulness, accessibility, and humanistic and social implications of computers. This is subtler to evaluate than programming ability.... I would expect the students' feelings that the computer is remote, daunting, vaguely threatening and inhuman, ... to decrease sharply (p. 12).

The computer course was given in the context of two regular courses taught at Hofstra University during the spring of 1969; a physical science course taught by Dr. Hart, and a natural science course taught by Dr. Esther Sparberg. The present report is concerned only with the data from the natural science course, as this constituted a large homogeneous group. Prior to the computer segment the students were given the pretest questionnaire. This was followed by the short computer course after which the questionnaire was administered for the second time with a few additional questions on a third page. There were 128 natural science students who took the pretest, 101 of whom also took the course and the posttest. The study sample thus consisted of 101 students for whom comparisons were made on pre-and posttest scores. The majors of the group could be categorized as follows: business, 51; humanities, 21; education, 18; social science, 7; undecided, 4.

Results

Description of computers. Table 1 presents the data regarding the computer descriptions. The semantic differential form used provided for five rating categories, e.g.: "slow ___ ___ ___ ___ ___fast" and the student was asked to select the most appropriate one. For purposes of this analysis the first two categories were combined to indicate "slow," the last two were recorded as "fast," and the middle rating was considered neutral.[1] The data indicate that the initial image of the

[1] In preparing the table, the frequencies of response to each dimension were examined. Each dimension was considered one at a time. The number of responses in the first two categories of each dimension were compared with the number of responses in the last two categories, and the more frequent response was listed in the table. For example, in the dimension "slow-fast," at pretest, 1% of the students responded in the first two categories (slow), 99% in the last two categories (fast), none in the middle category (neutral). The most frequent response in the comparison slow versus fast is fast, and accordingly fast was listed in Table 1. In the dimension "easy to use-hard to use," the relevant percentages were: easy to use (33%), hard to use (27%), neutral (41%). Since the percentage for easy to use exceeded the percentage for hard to use, the description "easy to use" was listed in the table.

computer primarily involved references to its speed, efficiency, and utility. This image was apparently sustained in the posttest, after the course program had intervened. Accuracy also occupies a high rank on both lists. It would appear that the students had a generally favorable image of the computer before the course began. Of the words on both lists the only possible unfavorable connotation is "inhuman" but then some might feel a machine cannot properly be described as "human" anyway.

Given the generally favorable pretest outlook toward the computer, one would look not for gross changes but for more subtle ones. A clear way to reveal the underlying pattern of change is to group the ratings in terms of each individual's initial and final rating. In that way one may assess where a student started and where he ended up. In the data analysis, which follows shortly, students whose initial ratings of the computer were at either extremity on any given dimension were not included. For example, the following frequencies were obtained for the slow-fast dimension:

slow	0	1	0	18	82	fast
	(1)	(2)	(3)	(4)	(5)	

For purposes of the data analysis the 82 students at rating point (5) were not included. Had there been any students at rating point (1), they would not have been included either. The intent of this exclusion is to avoid falling victim to the type of error sometimes noted in experimental research using scales which has been referred to as the "ceiling effect" (Murstein & Pryer, 1959). A person who makes an initial rating at the extreme top of a scale cannot go higher on the retest, he can only stay the same or go lower, he has reached the "ceiling," as it were, imposed by the particular rating scale being used. Similarly, a person who has started with the lowest possible rating cannot go any lower, even if he were so disposed. He is at the "basement" -- he may only stay the same or go higher.

In terms of the example, 82 individuals started out with a rating of the computer as extremely fast (5); 25 of these students chose the fourth rather than the fifth category at posttest. The net effect of this movement tends to foster the impression that the computer, on the average, was seen as slower at posttest than it was at pretest before the course began. But among the 57 students who seemingly did not change in their image of the computer as extremely fast, there may have been some who actually might have liked to say that they thought of the computer as even faster after taking the course, but had no way of showing this since they were already at the top of the scale. Had they been able to go past the ceiling they would have tended to neutralize the other students who were going downward. It might not then be possible to say that the general image of the computer registered slower at posttest than it did at pretest.

Because of this methodological problem, only students who started out with a (2), (3), or (4) rating on a given dimension were considered, since only these could move in either direction or stay the same. The twenty dimensions on the questionnaire (See Appendix) seem to involve obvious positive and negative poles; to be fast is generally better than to be slow; to be interesting better than to be boring, etc. Because of the arrangement in Table 2, the computer course may be thought of as having exerted a positive influence on the students' image of the computer whenever there are more students who indicate a "more" type of change than there are who indicate a "less" type of change. It can be seen in column 2 of Table 2 that of the 20 comparisons, the "more" changes occur more frequently than the "less" changes, 18 times or 90% of the time. One comparison ("more flexible-less flexible") resulted in a tie between "more" and "less" and in one comparison ("more human-less human") there was movement toward "less." It is perhaps too much to expect that contact with a computer would support the view that it was particularly human -- this point was made earlier -- to which now should be added the observation that the versatility of the computer apparently does not overcome demonstrations of the notion of the relative rigidity of the machine functioning. In this connection it is interesting to note Hart's description:

> My presentation relies heavily on the picture of the computer as a fast idiot, and the program as a set of explicit instructions to the idiot for doing what you want (1969, p. 6).

Turning now to the statistical significance of the differences observed, it should first be pointed out that the difference which indictaed that the computer was seen as less human at posttest is not significant, more than five times out of a hundred, a difference as large as the one obtained in connection with "more human-less human" could be obtained by chance alone. In order to accept a difference as significant, it is conventional to demand that a difference might be obtained by chance <u>less</u> than five times out of a hundred ($p < .05$). Thus, one might say, speaking of those students who change, that there is no particular tendency either way-- the computer is not perceived as more human at posttest--neither is it perceived as significantly less human.

Of the 18 differences whose direction suggests a more favorable computer image at posttest, 14 are statistically significant while 4 are not. The four which are not significant involve the adjectives "strong," "intelligent," "infallible," and "important." To recapitulate: Fourteen statistically significant differences were obtained in connection with the semantic differential as indicated by column 3 of Table 2. At posttest students studied tended to think of the computer as more: fast, worthwhile, good, beneficial, safe, rational, efficient, useful, approachable, interesting, accurate, understandable, easy to use, and productive than they did at pretest, before they took the course.

There is another aspect of the problem that should be considered, however. Simply comparing the "more" and "less" fractions of the results does not show how large a portion of the entire array of responses is involved in the comparison. Although this comparison is meaningful in its own right, it would be better if it could be shown that the students involved in the "more-less" comparison represented a sizeable group.

One way to tackle this question is to start by asking which of the three possible outcomes, "more," "less," or "same" is most typical. In other words, which is the dominant pattern of response? Inspection of column 1 of Table 2 shows that "more" was the most frequent outcome in 15 out of the 20 comparisons, "same" in 2 comparisons, "less" in 1, and there were 2 ties. The question was assessed statistically by considering each instance where an outcome's frequency seemed to exceed mere chance expectations and testing whether its elevation above chance was significant or not. In computing the chance expectancies for these data, each outcome was considered to have an equal tendency to occur. Thus, in effect, each student could have rated the computer "more" "less" or "same" and there is no particular reason why one outcome, by chance alone, should be favored over the others. The expectancies, therefore, are about 33% for each alternative.

Turning to column 4 of Table 2, it becomes apparent that there are eleven comparisons out of twenty where the "same" category exceeds a chance expectancy of 33%, only one of them (Dimension 20: "Importance") yielding a significant departure from chance expectancy ($z = 2.89$, $p < .01$).

In a parallel treatment of the data, column 6 of Table 2 presents instances where the "more" category appears to exceed chance expectancy. This occurs in 18 of the 20 comparisons. Of the 18, 13 are significant. Finally, since there was only one "less" comparison where "less" exceeded 33%, there is no table needed to present this outcome. In this one instance, 43% reported a "less human" image of the computer at posttest; the departure from chance expectancy is not significant.

Earlier it was noted that 14 of the comparisons showing preponderent favorable change within a sub-set of changing students were significant. The question was then raised as to the meaningfulness of this finding -- did the comparisons involve a substantial proportion of all the students responding? Very clearly the answer is yes. All but one of the 14 dimensions were associated with a significant proportion of students who responded more favorably at posttest than they did at pretest. These proportions ranged from 48 to 69 percent of the total subject sample, whereas the chance expectancy was only 33%. In the one dimension which failed to attain significance for its proportion of "more" responses, the proportion was still large (more fast--53%) but not large enough, in view of the relatively small sample (N=19), to be registered as statistically significant.

The extensiveness of the favorable increases is to be compared with the fate of other types of outcome. In no instance did the pattern of change go in a significantly unfavorable direction, and in only one case was "no change" a statistically significant dominant effect (most students rated the computer equally "important" at pre- and posttest).

One set of test questions asked the students to rate the usefulness of the computer in a number of disciplines. Like the other instruments, this was filled out both prior and subsequent to the course. The data indicate that major differences exist in the perceived usefulness of the computer in different disciplines. Prior to the course, the computer was rated as either of "much use" or "very much use" by 99% of the students in business, 76% in natural science, 60% in education, 40% in social science, 33% in law, and 7% in humanities. The post course ratings were similar: 97% in business, 83% in natural science, 66% in education, 64% in law, 48% in social science, and 21% in humanities.

Students at both pre- and posttest tend to consider computers most useful in business and natural sciences, while humanities is consistently thought of as the discipline in which the computer would be least useful.

In an attempt to analyze the changes in detail, the data were cross-tabulated and analyzed in the same way as the semantic differential data discussed earlier. In this analysis, the students who originally gave extreme ratings of "very much use" or "no use" were excluded, since their ratings could only change in one direction. The complete set of data is presented in Table 3.

In Table 3, columns 2 and 3, a consistent pattern is evident for all of the disciplines considered. Of those students who changed their opinions, most tended to view the computer as being more useful than they did before they took the computer course. Although all of the differences in columns 2 and 3 are statistically significant, the strongest effect is associated with the perceived usefulness of the computer in the natural sciences. With respect to natural sciences, 68% of the students at posttest thought of the computer as more useful, whereas only 6% thought of it as less useful and only 26% indicated no change in their opinions.

The proportion of students who retained their original impression of the computer's usefulness is considered in columns 4 and 5 of Table 3. Two of the disciplines, law and social sciences, were associated with a proportion of "same" responses which was significantly greater than the chance expectancy of 33%. Although "same" was the <u>single</u> largest pattern of response in these two instances, a majority of the students actually changed in both cases.

This indicates that the data given previously on the students who did change is meaningful--it is not based on just a small section of the total student sample. Of those who changed their opinions from pre- to posttest, a significantly greater number saw the computer as more useful as opposed to less useful in each of the disciplines.

Columns 6 and 7 of Table 3 present the complement of this analysis. In this table the "more useful" pattern is compared to the other responses combined, just as in columns 4 and 5 the "same" pattern is compared to the remaining responses considered as one. The two disciplines associated with a significant proportion of "more useful" responses were natural sciences and humanities. Of the two, natural sciences (as indicated earlier) presents the most impressive picture. It should be noted that while significance is attained for only two of the six disciplines, the "more useful" pattern represents a sizeable segment of the total pool of responses in each instance, never going below 39% of the students.

To summarize this section--in general the number of students giving "same" and "more useful" patterns were similar. However, of the students who changed from pre- to posttest, a statistically significant majority viewed the computer as more useful in connection with every discipline sampled. The sub-set of students who changed was in every instance a substantial group, ranging from 52 to 74 percent of the entire sample. Thus the positive results for the changing students can be regarded as not only statistically significant but meaningful as well.

When ratings of the personal usefulness of the computer are compared with the previous results for the semantic differential and the various disciplines, a decline in the proportion of individuals having a favorable evaluation of the computer is evident. In each category, less than a majority of the students felt at pretest that the computer was substantially useful personally ("very much" and "much" useful). The specific percentages were: "In your major courses"--44%; "In other courses"--19%; "In doing research"--44%; "After graduation"--39%. Following the computer course, at posttest there was still not a majority who felt the computer to be substantially useful to them personally except in the case of "doing research"--59%. The other post percentages were: "In your major courses"--40%; "In other courses"--24%; "After graduation"--40%.

The absence of a strongly positive indication of the computer's personal usefulness is apparent also in the analysis of change. Again restricting the analysis to those students whose initial ratings were moderate, the data are presented in Table 4. When the number of students at posttest who thought the computer was more useful to them personally was compared with the number who thought it was less useful (columns 2 and 3), in three of the four comparisons a greater number of students thought of the computer as more personally useful; but none of the three instances was statistically significant. In the remaining comparison -- usefulness after graduation -- more students thought the computer would be less useful rather than more useful, but this difference was not significant either. In view of the insignificant findings, further tests were not made on this aspect of the data.

Reactions to the Course

After the course was over the students were asked to respond to five questions pertaining to the course. One of the questions asked the students to rate how much they had learned from each aspect of the course; very much, quite a bit, or relatively little. Their responses are tabulated in Table 5. The largest response was "learned relatively little" in connection with five of the six aspects of the course. The exception was "talking to faculty and/or computer personnel," which resulted in at least "quite a bit" of learning for two out of three students. Stated in terms of percentages for the five aspects which are similar, 48 to 66 percent of the students say they learned relatively little. This leaves, however, a sizeable group of 34 to 52 percent who state that they learned a great deal. Thus, half or a little more than half of the sample reports that relatively little was learned while the remainder of the sample reports that a substantial amount was learned from the various aspects. The text booklet appears to have been associated with the least learning; talking to faculty and/or computer personnel, the most.

A second question was concerned with the students' reactions to the amount of time spent on specific parts of the computer course (Table 6). There it can be seen that the students typically indicated that too little time was spent on the various parts of the course. Apparently the students' especially felt that too little time was expended on programming instruction, learning to operate the computer and running the computer. In response to lectures, however, there is something of a trend in the opposite direction. Almost equal numbers of students responded with "just right" or "too little."

A third question was divided into two parts, one relating to the number of hours spent listening to lectures, the second part concerning the number of hours spent in studying or working at the Computer Center. The average student spent 2.7 hours listening to lectures and 2.4 hours studying or working at the Computer Center.

The fourth question involved an attempt to compare the computer section of the course with the regular course with respect to amount learned, interest level, and ease of understanding. When scale ratings of one to five were assigned to the descriptive statements "much better" (5), "better" (4), "same" (3), "worse" (2), "much worse" (1), the results show that the computer course approximately matched the regular course in terms of amount learned and ease of understanding, but was apparently considered a little more interesting (3.7 compared to a "same" score of 3.0).

The final question was open-ended. The students were asked to make suggestions for improving the computer course. Sixty-three students responded. Some gave more than one codeable response. The response frequencies are given in Table 7. It will be noted that a number of students reported a desire for more practical experience with the computer-- its basic operations (26%) and the programming (42%). This finding supports the previous observation that almost three-fourths of the students thought that too little time was spent on programming and on learning to operate the computer.

Discussion

The impact of the computer course is to be seen in the apparent realization of some of the goals set forth at the outset--to convey the idea that computers are a good thing (the semantic differential shows a shift to a more positive image of the computer at posttest)--to impress students with the relevance of the computer in a wide variety of fields (there are significant changes in that direction too) and specifically to convey the feeling that the computer is approachable, not frightening (the students do become more convinced of the computer's safety and approachability).

The findings seem to confirm the value of the course. At the same time, however, it is possible to point to some present limitations which may need to be studied in order to improve the course in the future.

Returning again to the strengths of the package to provide a frame of reference for its possible weaknesses, the most impressive attitudinal change seemed to be a general one--an increased appreciation of the computer as an efficient and useful machine which was safe and easy to use. In terms of the more concrete teachings of the course, a considerable number of students widened their views regarding the versatility of the computer's application, but changes in this direction were not as dramatic as the trends associated with the semantic differential.

The application of the computer to the student's personal uses was quite weak. It seemed that the students developed a more favorable overall orientation to the computer, to a lesser degree become more willing to grant its usefulness in a variety of disciplines, but fell short of acknowledging the personal usefulness of the computer in their courses after graduation--even in their research. In short, the computer was good, was useful, was versatile--for others, yet not for them. This attitude becomes comprehensible, perhaps, in connection with the students' report that not enough time was spent with programming and actual practice with the computer. The students may thus be expressing the realities of their actual competence; they have learned to appreciate the computer but they have not become programmers and they do not feel like computer operators. This is so despite the fact that they have learned a minimum of "instant fortran" as their elementary proficiency tests seemed to indicate. Perhaps a greater emphasis on the practical aspects of the course might be advisable, but not necessarily to the detriment of the orientation features of the package, which apparently have been successful in improving the computer's image. Admittedly, one of the strong points of the course is its brevity, but possibly the course could be slightly lengthened, experimentally, in order to better accommodate the practical phase.

In general, the student's sense of the computer's personal relevance would seem to depend largely on his feeling of competence in performing the necessary computer operations. There is little evidence of any particular attitude which would minimize student use of the computer.

However, one might ask specific questions regarding the limits of the students' apparent favorable attitude. For example, Hart's expectation that the computer would be seen in time as less inhuman was not borne out by the data. The computer was not seen as more intelligent or as more flexible, qualities which characterize human functioning at its best. Actually, Hart's didactic device, "the computer is a fast idiot" is not consistent with an expectation that the machine also be human. The machine was seen as a machine, with the virtues of a machine and machine limitations as well. If the machine is fast but dumb, is it not to be hoped that man shall be slow but wise? Part of the resistance to computers may be due to a rational complaint rather than a unreasonable aversion. A researcher's thinking processes need not stop when a problem is given over to the computer--ultimately the researcher must make many decisions on his own based on logic and experience.

Table 1

Computer Descriptions

Description	Pretest Percentage of Students Checking (N=101)	Rank	Posttest Percentage of Students Checking (N=101)	Rank
Fast	99	1	91	4.5
Useful	95	2	96	1.5
Efficient	91	3	96	1.5
Important	89	4.5	86	8
Worthwhile	89	4.5	91	4.5
Accurate	88	6	95	3
Productive	82	7	90	6
Inhuman	81	8	71	13
Good	79	9	84	9
Beneficial	77	10	88	7
Strong	74	11	68	14
Understandable	68	12	83	10
Interesting	66	13	79	12
Rational	65	14.5	67	15
Safe	65	14.5	82	11
Approachable	51	16	64	16
Flexible	44	17	49	19
Intelligent	42	18	53	18
Infallible	34	19	43	20
Easy to use	33	20	56	17

Table 2

Image of the Computer: Percent Changes from Pretest to Posttest

Adjective	Total	More vs. Less	t	Change vs. No Change	t	More vs. Others	t	N
More fast	53	91	2.41**	58	.58	53	1.56	19
Less fast	5	9						
Same	42			42		47		
More strong	36	62	1.31	58	1.44	36	.37	64
Less strong	22	38						
Same	42			42		64		
More worthwhile	53	84	2.75***	63	.23	53	2.17*	30
Less worthwhile	10	16						
Same	37			37		47		
More good	51	86	3.95***	58	1.16	51	2.63***	53
Less good	8	14						
Same	42			42		49		
More intelligent	40	56	.55	71	.45	40	.85	42
Less intelligent	32	44						
Same	29			29		60		
More beneficial	52	93	4.11***	56	1.35	52	2.60***	46
Less beneficial	4	7						
Same	44			44		48		
More safe	65	89	5.34***	73	.86	65	5.42***	66
Less safe	8	11						
Same	27			27		35		
More flexible	35	50	0	70	.21	35	.09	49
Less flexible	35	50						
Same	31			30		65		
More human	27	39	.98	70	.24	27	.59	37
Less human	43	61						
Same	30			30		73		

(Table 2 cont'd. on next page)

Table 2 (Cont'd.)

Adjective	Total	More vs. Less	t	Change vs. No Change	t	More vs. Others	t	N
More rational	49	73	2.37**	67	0	49	2.12*	45
Less rational	18	27		33		51		
Same	33							
More efficient	67	89	4.08***	74	.82	67	4.29***	39
Less efficient	8	11		26		33		
Same	26							
More useful	55	100	3.88***	55	1.26	55	2.41**	31
Less useful	0	0		45		45		
Same	45							
More approachable	48	77	3.44***	62	.71	48	2.54**	66
Less approachable	14	23		38		52		
Same	38							
More interesting	52	74	3.04***	69	.27	52	2.97***	62
Less interesting	18	26		31		48		
Same	31							
More accurate	69	94	4.87***	73	.73	69	4.98***	47
Less accurate	4	6		27		31		
Same	27							
More understandable	52	82	4.06***	62	.71	52	3.06***	66
Less understandable	11	18		38		48		
Same	38							
More easy to use	48	76	3.54***	63	.57	48	2.73***	79
Less easy to use	15	24		37		52		
Same	37							
More productive	61	85	4.16***	72	.66	61	4.26***	54
Less productive	11	15		28		39		
Same	28							
More infallible	45	58	.99	63	.57	37	.51	79
Less infallible	32	42		37		63		
Same	23							
More important	27	60	.67	46	2.89***	27	.64	44
Less important	18	40		54		73		
Same	54							

1--Relevant Sample--number of students with pretest rating of "2", "3", or "4".
***--p < .01; **p < .02; *p < .05.

Table 3

Ratings of the Usefulness of the Computer in Selected Disciplines.

Percent Changes from Pretest to Posttest

Discipline	Description	Total	More vs. Less	t	Change vs. No Change	t	More vs. Others	t
Hum.	More useful	44	75	3.32***	59	1.50	44	1.97*
	Less useful	15	25					
	Same	41			41		56	
Nat. Sci.	More useful	68	92	4.93***	74	.90	68	5.11***
	Less useful	6	8					
	Same	26			26		32	
Soc. Sci.	More useful	39	73	2.98***	54	2.50**	39	1.11
	Less useful	14	27					
	Same	46			46		61	
Bus.	More useful	56	83	2.02**	67	0	56	1.81
	Less useful	11	17					
	Same	33			33		44	
Educ.	More useful	41	72	4.40***	57	1.63	41	1.37
	Less useful	16	28					
	Same	43			43		59	
Law	More useful	40	76	2.78***	52	2.33**	40	.99
	Less useful	12	24					
	Same	48			48		60	

***--$p < .01$
**--$p < .02$
*--$p < .05$

Table 4

Ratings of the Personal Usefulness of the Computer
Percent Changes from Pretest to Posttest

Relation to	Description	Total	More vs. Less	t
Major courses	More useful	33	55	.49
	Less useful	27	45	
	Same	41		
Other courses	More useful	35	59	.96
	Less useful	17	41	
	Same	58		
Research	More useful	39	59	1.14
	Less useful	27	41	
	Same	34		
After Graduation	More useful	21	45	.36
	Less useful	25	55	
	Same	54		

Table 5

Posttest Description of Amount Learned from Various
Aspects of Computer Course

	Percent Checking			
Description	Very Much	Quite a Bit	Relatively Little	Mean[a] (N=101)
Talking to faculty and/or computer personnel	26	42	32	1.95
Talking to other students	20	29	50	1.70
Material on the bulletin board	12	40	48	1.64
The lectures in class	9	41	49	1.60
The handouts	3	39	58	1.45
The text booklet	4	29	66	1.38

[a]means were derived from ratings very much = 3, quite a bit = 2, and relatively little = 1.

Table 6

Reactions to the Amount of Time Devoted to the Computer Part of the Course

Area of the Course	Percent Checked Too Much	Just Right	Too Little	Mean[a] (N=101)
Lectures in general	23	37	39	1.84
The entire computer section	11	39	49	1.62
Learning to keypunch	4	47	48	1.56
Running the computer	2	29	68	1.33
Learning to operate the computer	3	25	71	1.31
Programming instructions	3	23	73	1.29

[a]means were derived from ratings too much = 3, just right = 2, and too little = 1.

Table 7

Suggestions for Improving the Computer Part of the Course

Suggestion	Number (N=52)	Percentage
More time in Center--more practical experience programming	22	42
Existing course should be extended	14	27
Lectures should relate to the basic operations of the computer	13	26
Course should be taught as a separate course	4	8
Class should be divided into smaller groups	4	8

References

Hart, Robert. Quick and dirty introduction to the computer for masses of nonscience students. Unpublished manuscript, Hofstra University New York, 1969.

Murstein, B.I., & Pryer, R.S. The concept of projection: A review. Psychological Bulletin, 1959, 56, 353-374.

APPENDIX

Testing Instrument Used in Study

Semantic Differential

On each line below there are two adjectives representing opposites. Each set of adjectives is separated by five lines. Please rate the concept "computer" by checking one of the five categories between each pair of terms, in order to indicate which of the two opposites best describes the concept. Thus, if the two words listed are black and white, you would check the line closest to black if you believe this term is the most descriptive, the line closest to white if that is most descriptive, and one of the three middle terms to represent combinations of black and white. Although some of the pairs of terms might seem to be unrelated to the concept, rate them as best you can. Please make a check mark (X) on every line.

slow	___	___	___	___	___	fast
strong	___	___	___	___	___	weak
worthwhile	___	___	___	___	___	worthless
good	___	___	___	___	___	bad
intelligent	___	___	___	___	___	unintelligent
harmful	___	___	___	___	___	beneficial
safe	___	___	___	___	___	dangerous
flexible	___	___	___	___	___	rigid
human	___	___	___	___	___	inhuman
irrational	___	___	___	___	___	rational
efficient	___	___	___	___	___	inefficient
useful	___	___	___	___	___	useless
approachable	___	___	___	___	___	unapproachable
boring	___	___	___	___	___	interesting
accurate	___	___	___	___	___	inaccurate
understandable	___	___	___	___	___	incomprehensible
easy to use	___	___	___	___	___	hard to use
productive	___	___	___	___	___	destructive
fallible	___	___	___	___	___	infallible
important	___	___	___	___	___	unimportant

How Useful Are Computers?

A. Please rate the extent to which computers would be useful in each of the following disciplines. Indicate your opinion by placing a checkmark (X) in the appropriate column for each discipline.

	Very Much Use	Much Use	Some Use	Little Use	No Use
Humanities	____	____	____	____	____
Natural Sciences	____	____	____	____	____
Social Sciences	____	____	____	____	____
Business	____	____	____	____	____
Education	____	____	____	____	____
Law	____	____	____	____	____

B. Now rate the extent to which computers would be useful to you. Indicate your current opinion.

	Very Much Use	Much Use	Some Use	Little Use	No Use
In your major courses	____	____	____	____	____
In other courses	____	____	____	____	____
In doing research	____	____	____	____	____
After graduation	____	____	____	____	____

C. What is your major? ______________________________

Computer Course Questionnaire

1. How much did you learn from each of the following aspects of the part of the course dealing with computers?

	Very Much	Quite a Bit	Relatively Little
The lectures in class	___	___	___
The text booklet	___	___	___
The handouts	___	___	___
Material on the bulletin board	___	___	___
Talking to faculty and/or computer personnel	___	___	___
Talking to other students	___	___	___

2. What was your reaction to the amount of time devoted to the computer part of the course?

	Too Much	Just Right	Too Little
The entire computer section	___	___	___
Lectures in general	___	___	___
Programming instruction	___	___	___
Learning to operate the computer	___	___	___
Learning to keypunch	___	___	___
Running the computer	___	___	___

3. Approximately how many hours did you spend on each of the following parts of the computer section of the course?

   Listening to lectures? ___

   Studying or working at the Computer Center? ___

4. How did the computer part of the course compare with the other parts of the course with respect to each of the following?

	Much Better	Better	Same	Worse	Much Worse
Amount learned	___	___	___	___	___
Interest level	___	___	___	___	___
Ease of understanding	___	___	___	___	___

5. On the back of this sheet, please make suggestions for improving the computer part of the course.